6.15. The U.S. Geological Survey Huron-Erie Corridor Initiative

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Introduction

In 2004, the Huron-Erie Corridor (HEC) Initiative was proposed by the U.S. Geological Survey's Great Lakes Science Center to address high-priority research needed to understand and remediate the impacts of habitat loss and degradation as well as invasive species on fishery resources in the HEC. The HEC includes the waters of southern Lake Huron, the St. Clair River, Lake St. Clair, the Detroit River, and western Lake Erie. Waste disposal, navigation, water withdrawal, and shoreline development have decreased the ecological resilience of this ecosystem and altered or degraded habitats for fish and wildlife. The purpose of the HEC Initiative is to create relevant new science to allow natural resource managers to better manage fish and wildlife and their habitats in the HEC. The Initiative is a binational, collaborative partnership of over 20 organizations, including government, industry, tribal and university participants. Resource managers, scientists, and other stakeholders are using a consensus-building, multidisciplinary approach to identify research themes and priorities, develop funding strategies, and increase public involvement in the Initiative.

The HEC is an important ecological, economic, and recreational resource that is subject to conflicting needs of multiple user groups. For example, over five million people live within an hour's drive of the HEC. It is a source of drinking and process water for numerous cities and industries, and receiving waters for their waste discharges. International trade routes through the HEC move more than $80 billion in goods per year. There are over a million registered boats in Michigan, and about half of them use the HEC for fishing and other recreational activities. The Detroit River International Wildlife Refuge, Ottawa National Wildlife Refuge, and tribal lands are located within the HEC. Sixteen species of threatened or endangered fish reside in the HEC, and it is used by millions of migratory waterfowl. Five Areas of Concern (AOCs) identified by the International Joint Commission are found in the HEC. These AOCs possess 14 Beneficial Water Use Impairments, including loss of fish and wildlife habitat (Hartig et al. 1997, Manny 2003b).

To address the many challenges to the HEC, a multidisciplinary steering committee has been formed comprised of scientists, managers, and other stakeholders with a strong interest in the aquatic ecosystems of the HEC. At the organizational meeting held in February 2005, resource managers identified the scientific information needed to better manage natural resources, and goals of the Initiative were created.

Goals and Objectives of the HEC Initiative

A primary goal of the Initiative is to identify historic reference conditions and provide research to support restoration of habitat and ecosystem function. One key objective is to use historic data to quantify and model fish populations in the context of:

- The diversity and quantity of habitats present in the HEC prior to development, and the abundance and diversity of fish populations maintained by various habitat types
- Hydrologic flow and water depths that characterize productive habitats for valued fish species
- The juxtaposition of spawning, nursery, feeding, and home-range habitats for valued fish species in the HEC ecosystem

Initial research questions include the following considerations. How did the pre-development HEC ecosystem function, and what functional elements are still operative in the ecosystem? For example, what is the feasibility of restoring spawning habitat for valued native fishes? Can we inventory functional fish spawning, egg incubation, and nursery habitat? Can we identify, quantify, and model the connective mechanisms between life history and stage-specific habitats? Can we model the effects of water levels and flows on habitat suitability for fish? Can degraded habitats be restored? Can strategies for fish habitat restoration be developed? Lastly, how shall we assess the cumulative effects of each habitat restoration project?

Initially, scientists will compile historic data to model the pre-development ecosystem, determine reference conditions of habitats, hydrology, and fish community composition, and model ecosystem functions. Data gaps will then be modeled. The USGS will assemble its scientific data for the Corridor in digital form as information layers in a Geographic Information System. Those data can then be modeled to determine how the pre-development river system may have behaved hydrologically, sustained fish habitat, and produced large numbers of valued fish. Based on this historic assessment, it may be possible to determine which habitat types are limiting the abundance of high-value fishes in the Corridor today and where those habitats can be recreated economically. Scientific insights gained from such models could be used to manipulate the currently degraded ecosystem and restore as much ecological resiliency, biological productivity, and desirable natural resources as possible for the use and enjoyment of the public. It is likely that the restored and created habitats will be colonized by undesirable non-native species, so scientists and engineers will need to consider this factor. They will require detailed knowledge of the spawning and nursery requirements of both native and non-native fishes to enhance the productivity of native fishes while reducing that of non-native fishes. Likewise, resource managers will be challenged to manage for desirable species and against non-native species.

Proposed Research

Native fish populations in the HEC have been greatly affected by habitat alterations. Millions of tons of limestone bedrock, cobble and gravel were removed from the St. Clair and Detroit Rivers to build the cities of Detroit and Windsor and create navigation channels (Larson 1981, Figure 1). These gravel and rock substrates provided spawning and nursery habitat for lake whitefish (*Coregonus clupeaformis*), walleye (*Sander vitreus*), lake sturgeon (*Acipenser fulvescens*), and many other native fishes. The Livingston Channel project of the early 1900s was particularly damaging. A 19-km channel was created in the limestone bedrock sill at the mouth of the Detroit River with a minimum width and depth of 91 m and 6.7 m, respectively (Larson 1981). Although dredging had taken place

in that area for more than 30 years, this project greatly altered the river's hydrology and destroyed the lake whitefish spawning grounds in the river (U.S. Bureau of Fisheries 1917, Manny et al. 1988).

The altered hydrology of the Detroit River resulting from the Livingston Channel project may be affecting fish recruitment. River discharge affects the connectivity of spawning, incubation, and nursery areas for most fishes in the lower HEC. Prior to the construction of shipping channels in the lower Detroit River, river water was discharged in a diffuse manner from the river mouth into the western basin of Lake Erie (Figure 2). Water dispersed across a wide area of the basin, including much nearshore habitat along the Michigan shoreline to the west of the river mouth as well as coastal areas to the east along the Ontario shoreline. Now the Livingston Channel in the lower Detroit River focuses discharged river water out and away from productive coastal areas into deeper, less productive offshore waters of the western basin. Characteristics of this new hydrologic pattern also include lower residence time in the river, increased discharge velocity, and possible thermal differences. We hypothesize that this alteration in river hydrology represents a major disconnect between river spawning and incubation areas and productive nursery habitats for fish in western Lake Erie.

Ongoing Research

Since 1998, the Great Lakes Science Center (GLSC), in collaboration with its partners, has conducted research to gather information needed for the successful restoration of a remnant population of native lake sturgeon in the HEC, including stock-size assessment and habitat evaluation (Hill and Manny 1999, McClain and Manny 2000, Alpena FRO 2003, MDNR 2002), spawning success and early life history (Nichols et al. 2003), extent and composition of known-active and historic-reputed spawning grounds (Manny and Kennedy 2002; Manny 2003a), sturgeon movements (Boase 2003, Caswell et al. 2004), and body burden of contaminants in lake sturgeon (Begnoche et al. 2003). The GLSC and partners are working to restore lake sturgeon populations by creating lake sturgeon spawning habitat in the Detroit River near Belle Isle to replace habitat lost to dredging. This habitat was constructed in June 2004 as part of the Belle Isle/Detroit River Sturgeon Habitat Restoration, Monitoring, and Education Project. It will be closely monitored to assess the success of the project (cf. Manny et al., Section 6.16).

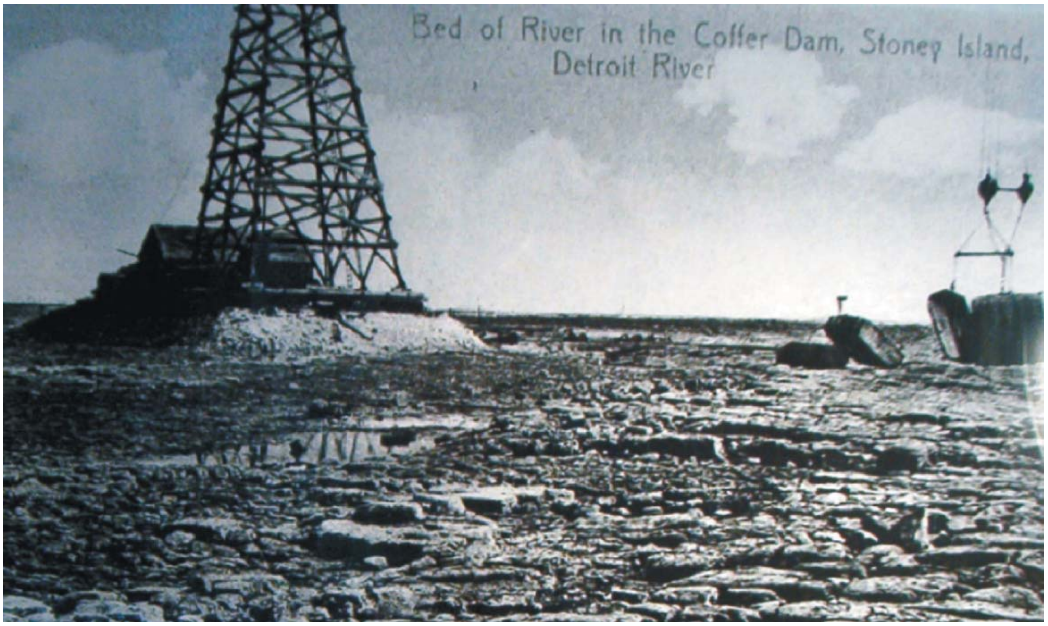

Figure 1A. Historic limestone bedrock fish spawning habitat in the lower Detroit River in the Livingston Channel prior to blasting and dredging in 1907 (Source: Library of Congress).

Figure 1B. Removal of historic limestone bedrock fish spawning habitat in the lower Detroit River during the 1907 Livingston Channel project (Source: Library of Congress).

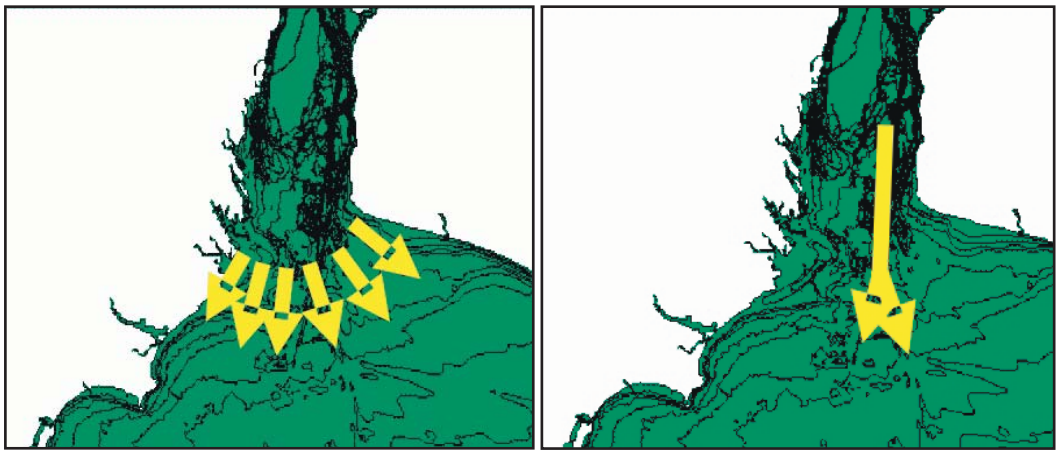

Figure 2. Historic (diffuse) and present (direct) river discharge patterns of the Detroit River.

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